NEW DRAWINGS

S.N. : 07/016,923
BATCH NO. : 0-49
DATE OF NOTICE OF ALLOWANCE: 12/7/88

A. ☐ The informalities noted on the PTO-948, attached to Paper No._____ has been:

1. ☐ Corrected on the original drawings.

2. ☐ Corrected on substitute sheets of drawings. Please substitute these drawings for the original drawings.

B. ☒ The Examiner approved changes to the drawings, Paper No(s)_____ , have been:

1. ☐ Made in the original drawings.

2. ☒ Made on substitute sheets of drawings. Please substitute these drawings for the original drawings.

C. ☐ Other

The corrected and/or amended or substitute drawing(s) have been returned to the P.T.O. on _____.
BY QUINN PATENT DRAWING SERVICE, INC.

1. An improvement for a selectable phase shifter incorporating an ouput and a plurality of inputs, one of which is an input signal and another which is coupled to a phase shifted input signal, the improvement comprising a further input coupled to a further phase shifted input signal, said signals having different relative phases and a portion means having an adjustment capability, which portion means is coupled to the plurality of inputs and said further input and responsive to the signals thereof to linearly pass a portion of at least one of the signals to said output, which portions are responsive to said adjustment of said portion means.

2. The improved selectable phase shifter of claim 1 characterized in that said further phase shifted input signal is phase shifted by a different amount than the input signal or the phase shifted input signal.

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3. The improved selectable phase shifter of claim 1 characterized by the addition of another input coupled to an even further phase shifted input signal and said portion means coupled to said another input coupled to an even further phase shifted input signal with said portion means operable such that said device may output a portion of said further phase shifted input signal and a portion of said even further phase shifted input signal so as to allow for an even further range of available phase shift.

4. The improved selectable phase shifter of claim 3 characterized in that said even further phase shifted input signal is derived directly from the input signal without substantial phase shift.

generator circuits are well known in the art, and could be used for the ramp generating function. While shown specifically in an analog embodiment, it will be understood by one skilled in the art that digital implementations of any or all of the above described functions and means can be utilized.
Mechanical or electronic embodiments of the various functions can also be utilized, for example: the claimed portion means may be comprised of a mechanically resistive embodiment, such as that of Fig. 5, or of an electronic embodiment, such as the multipliers for Fig. 7. The control means or element can be mechanical, such as 11c of Fig. 5, or electronic, such as in Fig. 7. Other features and elements of the invention may also be implemented in either mechanical or electrical form, as will be apparent to one skilled in the art from the teachings herein.

Figure 10 shows typical waveforms which would be seen for the circuit of Fig. 7. The waveforms of Fig. 10 are also similar to those of Fig. 9, except that the wiper rotation waveform 25 has been replaced with input pulse 29 and Ma - Md (20a - 20d), the same as in Fig. 8. Figure 10 shows input waveform 27 which is input to phase shift means 6e, and outputs 28a -28d corresponding to ?A - ?D. Output waveform 30 corresponds to the output from 21. It can be seen that the multipliers 17 and control element 23 essentially provide the same function as the circular resistive element and wiper shown in Fig. 4, thereby achieving the phase shift. The operation of Fig. 7 is essentially the same as that of Fig. 4, except that a given phase shifted signal (or portions of two phase shifted signals) is selected by a multiplier 17 in response to 23, whereas in the circuit of Fig. 4, the selection is provided by rotating the wiper. The phase of waveform 30 corresponds to ?D between time V and time W. AT time W, Md decreases and Ma increases, and the phase of 30 is the vector sum of ?A and ?D. At time X, 30 has the same phase as ?A. For the time period from Y to Z, the output 30 has a frequency shift. While signals Ma - Md have been shown as triangular in shape, other shapes will also work. It has been found that a half sinusoid shape works well in terms of minimizing distortion on the output signal. There is no requirement that a complete transition from minimum to maximum be made within any given time and these signals may as well be caused to make only a partial change and then stop.
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5. The improved selectable phase shifter of claim 3 characterized in that said even further phase shifted input signal is phase shifted 360 degrees with respect to the input signal.

6. The improved selectable phase shifter of claim 3 characterized by said portion means includes a control element operable such that the device may output a portion of said input signal and a portion of said even further phase shifted input signal so as to allow for a continuous available phase shift the equivalent of 360 degrees by said phase shifter.

7. The improved selectable phase shifter of claim 6 wherein said portion means includes a resistance element configured in a ring and having taps coupled to the input signal, the phase shifted, further phase shifted and even further phase shifted input signals which tap's are

the aforementioned inputs.

8. The improved selectable phase shifter of claim 1 characterized in that said portion means includes a selectable resistance tap, and the output is coupled to said selectable resistance tap.

9. The improved selectable phase shifter of claim 8 characterized in that the selectable resistance tap is a mechanically movable resistance tap.

10. The improved selectable phase shifter of claim 8 characterized in that the selectable resistance tap is an electrically changeable resistance tap.

11. The improved selectable phase shifter of claim 1 wherein said portion means is controlled by an electrical signal.

12. The improved selectable phase shifter of claim 1 characterized in that the portions of the signals to the output are developed in a tapped delay line.

13. An improvement for a phase shifter incorporating an input signal and a phase shifted input signal having a different relative phase, characterized in that the input signal is coupled to a first multiplier means and said phase shifted input signal is coupled to a second multiplier means, said first multiplier means and said second multiplier means having a single common output, and operating to output a selectable phase shifted signal which is a combination which includes a first portion derived from said input signal and a second portion derived

from said phase shifted input signal and control means to provide control signals to control said first multiplier means and said second multiplier means to selectively alter said first and second portions so as to provide for a selectable phase shifted signal at said common output, the phase of which changes in response to the amount of said portions.

14. The improved phase shifter of claim 13 characterized by said control means including a control voltage means connected to said first multiplier meeans and second multiplier means such that the signal applied to the multiplier is altered by the control voltage.

15. An improvement for a selectable phase shifter incorporating an output comprised of a movable tap coupled to a resistance element, Said element extending from a first fixed tap responsive to an input signal past a second fixed tap responsive to a phase shifted input signal to a third fixed tap responsive to another signal, said signals having different relative phases, the improvement comprising the resistance element extending in continuous fashion from the first fixed tap, past said second fixed tap, past said third fixed tap, back to said first fixed tap.

16. An improved selectable phase shifter for an input signal, said shifter comprising means to delay the input signal to provide a delayed input signal, an output, variable multiplier means for the input signal for providing a multiplied input signal as part of said output, second variable multiplier means for said delayed input signal for providing a multiplied delayed signal as part of

said output, and means to control said variable multiplier and said second variable multiplier so as to produce a selectable phase shifted signal at said output.

17. Apparatus for providing a phase shifted version of an electronic signal, including in combination a phase shift means responsive to said electronic signal to provide three or more relatively phase shifted signals, one of which may be equivalent to said electronic signal, a impedance means having an output, an adjustment element and three or more terminals, with each of said terminals being operative to receive one of said phase shifted signals and providing a selectively variable impedance through said adjustment element bewteen said terminals and said output, said adjustment element operating to selectively vary said impedances from a plurality of terminals to said output to allow a first portion of said output to be dreived from one of said phase shifted signals, in response to the aforementioned impedance through which said phase shifted signal flows and a second portion to be derived from a second of said phase shifted signals in response to the aforementioned impedance through which said second phase shifted signal flows which portions may include zero for one of the signals, and which portions are responsive to said adjustment element.

18. Apparatus as claimed in claim 17 wherein said impedance means includes a resistor with said adjustment element comprised of an adjustable tap on said resistor.

19. Apparatus as claimed in claim 17 wherein said impedance means is comprised of an electronic device which is coupled to pass

any portion of any one or two phase shifted signals in response to said adjustment element.

20. Apparatus as claimed in Claim 17 wherein said impedance means is response to at least four relatively phase shifted signals.

21. A resistive device having a resistance means with three or more receiving terminals configured to receive electronic signals all having different relative phases, and having an adjustment element controllable to provide an output signal at a further terminal which output signal includes one or a combination of two of the electronic signals which are applied to a given two of said receiving terminals, which combination is controlled by said adjustment element such that said device may pass any portion of one or two phase shifted signals to the output.

22. Apparatus as claimed in claim 21 wherein said resistance means has four or more receiving terminals configured to receive electronic signals.

23. Apparatus as claimed in claim 21 wherein said adjustment element is adjustable in a fashion such that said output may include a combination of portions of a first and a second of said electronic signals or a combination of portions of said second and a third of said electronic signals.

24. Apparatus as claimed in claim 21 wherein said resistance means is arranged in a continuous loop between said receiving terminals.

25. Apparatus as claimed in Claim 22

21 wherein said resistance means is arranged in a circular
fashion with said receiving terminals being
arranged substantially equally spaced along said resistance
means.
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